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## A Tale of Two Islands (A Fable)

Peter J. Denning

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A TALE OF TWO ISLANDS  
(A FABLE)

Peter J. Denning  
Computer Sciences Department  
Purdue University  
West Lafayette, Indiana 47907

CSD-TR 342

A TALE OF TWO ISLANDS  
(A Fable)

Peter J. Denning

Once upon a time there were two islands. One was called Stochasia. Its citizens were well cultured and they had achieved high development in a system of mathematics for random processes. The other island was called Operatia. Its citizens were well cultured and they had achieved high development in a system for experimentation with nondeterminate phenomena. Both civilizations were closed societies. Neither knew of the other's existence, and it had been so since the beginning of time. Neither would ever have known, had it not been for the events I will describe shortly.

At a moment shrouded in the mists of antiquity, a great sage of Stochasia posed this problem: Given the matrix  $[p_{ij}]$  of transition probabilities, find the equilibrium distribution  $\underline{p}$  of occupying the possible states. The greatest minds of Stochasia worked on this problem, eventually finding a solution, which they engraved in stone.

At a moment shrouded in the mists of antiquity, a great sage of Operatia posed this problem: Having observed the matrix  $[q_{ij}]$  of transition frequencies, calculate the distribution  $\underline{q}$  of proportions of times of occupying the possible states. The greatest minds of Operatia worked on this problem, eventually finding a solution, which they engraved

in stone.

These things happened a long time ago.

In a recent time, there was an anthropologist who specialized in islands. He discovered our two islands from photographs taken by an orbiting satellite. He went to visit Stochasia, where he discovered their stones and found that the Stochasians still use the knowledge inscribed on them. He also visited Operatia, where he discovered their stones and found that the Operatians still use the knowledge inscribed on them.

Struck by the similarity of the inscriptions, the anthropologist asked the elders of each island to evaluate the approach used by the other island. In due course each island's elders reached a decision.

The elders of Operatia told the anthropologist: "The Stochasians are obviously confused. They have developed a highly indirect approach to solving the problem posed once by our great sage. First, they transform the problem into an untestable domain by a process we would call 'abstraction'. Using their method, they find the abstract answer corresponding to the abstract problem. Finally, they equate the abstract result with the real one by a process we would call 'interpretation'. They make the audacious claim that their result is useful, even though the two key steps, abstraction and interpretation, can nowise be tested for

accuracy. Indeed, these two key steps cannot be tested even in principle! Our approach, which directly calculates the real result from the real data, is clearly simpler. Their approach is riddled with untestable assumptions and cannot be trusted."

The elders of Stochasia told the anthropologist: "The operations are obviously confused. They have developed a highly indirect approach to solving the problem posed once by our great sage. First, they restrict the problem to a single case by a process we would call 'estimation'. Using their method, they estimate the answer corresponding to their estimate of the problem. Finally, they equate the estimated result with the real one by a process we could call 'induction.' They make the audacious claim that their result is useful, even though the two key steps, estimation and induction, are nowise error free. Indeed, these two key steps cannot be accurate even in principle! Our approach, which directly expresses the real result in terms of the real matrix, is clearly simpler. Their approach is riddled with error and cannot be trusted."

The anthropologist believed both these arguments and was confused. So he went away, and searched for new islands.

Some years later, the anthropologist discovered a third island called Determia. Its citizens believe that randomness is an illusion. They are certain that all things can

be completely explained if all the facts are known. On studying the stones of Stochasia and the stones of Operatia, the elders of Determia told the anthropologist: "Both the Stochasians and the Operations are confused. Neither's approach is valid. All you have to do is look at the real world, and you can see for yourself whether or not each state is occupied. There is nothing uncertain about it: each state is or is not occupied at any given time. It is completely determined."

One day at tea, the anthropologist told this to a Stochasian, who laughed: "That's nonsense. It is well known that deterministic behavior occurs with probability zero. Therefore, it is of no importance." Another day at tea, the anthropologist also told this to an Operatian, who laughed: "I don't know how to respond. We have not observed such behavior. Therefore, it is of no importance."

The anthropologist believed all these arguments and was confused. So he went away, and searched for new islands. I don't know what became of him, but I heard he discovered Noman.\*

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\*Noman is an island.